Chapter 8
Configure Circuit and Translational Cross-Connects

Circuit cross-connect (CCC) and translational cross-connect (TCC) allow you to configure transparent connections between two circuits, where a circuit can be a Frame Relay DLCI, an ATM VC, a PPP interface, a Cisco HDLC interface, or an MPLS label-switched path (LSP). Ethernet interfaces with VLAN tagging enabled can use Ethernet CCC encapsulation. This encapsulation type is supported only on the four-port Fast Ethernet PIC.

Using CCC or TCC, packets from the source circuit are delivered to the destination circuit with, at most, the Layer 2 address being changed. No other processing, such as header checksums, TTL decrementing, or protocol processing, is done.

To connect interfaces of the same type, use CCC. To connect unlike interfaces, use TCC.

CCC and TCC circuits fall into three categories: logical interfaces, which include ATM VCs and Frame Relay DLCIs; physical interfaces, which include PPP and Cisco HDLC; and paths, which include LSPs. The three circuit categories provide three types of cross-connect:

- Layer 2 switching (interface-to-interface)—Cross-connects between logical interfaces provide what is essentially Layer 2 switching.

- MPLS tunneling (interface-to-LSP)—Cross-connects between interfaces and LSPs allow you to connect two distant interface circuits by creating MPLS tunnels that use LSPs as the conduit.

- LSP stitching (LSP-to-LSP)—Cross-connects between LSPs provide a way to “stitch” together two label-switched paths, including paths that fall in two different TED areas.

The cross-connect is bidirectional, so packets received on the first interface are transmitted out the second interface, and those received on the second interface are transmitted out the first.

For all CCC connections that connect interfaces, the interfaces must be of the same type; that is, ATM to ATM, Frame Relay to Frame Relay, PPP to PPP, or Cisco HDLC to Cisco HDLC.

For all TCC connections that connect interfaces, the interfaces can be of unlike types. Mainly, TCC is used for Layer 2.5 VPNs, but it can also be used as a simple “unlike circuit” switch.

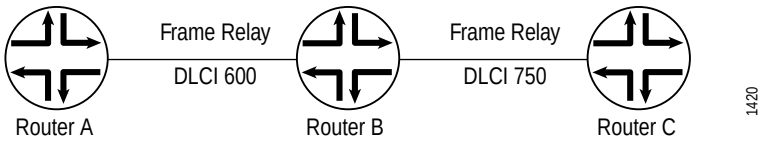
This chapter discusses the Layer 2 switching cross-connect configuration tasks. For information about MPLS tunneling and LSP stitching, see the *JUNOS Internet Software Configuration Guide: MPLS Applications*. For information about Layer 2 and Layer 2.5 virtual private networks (VPNs), see the *JUNOS Internet Software Configuration Guide: VPNs*.

Configure Layer 2 Switching Cross-Connects

Layer 2 switching cross-connects join logical interfaces to form what is essentially Layer 2 switching.

Figure 5 illustrates a Layer 2 switching circuit cross-connect. In this topology, Router A and Router C have Frame Relay connections to Router B, which is a Juniper Networks router. CCC allows you to configure Router B to act as a Frame Relay (Layer 2) switch. To do this, you configure a circuit from Router A to Router C that passes through Router B, effectively configuring Router B as a Frame Relay switch with respect to these routers. This configuration allows Router B to transparently switch packets (frames) between Router A and Router C without regard to the packets' contents or the Layer 3 protocols. The only processing that Router B performs is to translate DLCI 600 to 750.

Figure 5: Layer 2 Switching Circuit Cross-Connect



If the Router A–to–Router B and Router B–to–Router C circuits are PPP, for example, the Link Control Protocol and Network Control Protocol exchanges occur between Router A and Router C. These messages are handled transparently by Router B, allowing Router A and Router C to use various PPP options (such as header or address compression and authentication) that Router B might not support. Similarly, Router A and Router C exchange keepalives, providing circuit-to-circuit connectivity status.

You can configure Layer 2 switching cross-connects on PPP, Cisco HDLC, Frame Relay, Ethernet CCC, and ATM circuits. With CCC, only like interfaces can be connected in a single cross-connect. With TCC, unlike interfaces can be connected in a single cross-connect. In Layer 2 switching cross-connects, the exchanges take place between between point-to-point links.

To configure Layer 2 switching cross-connects, you must configure the following on the router that is acting as the switch (Router B in Figure 5):

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Define the Encapsulation for Layer 2 Switching Cross-Connects

To configure Layer 2 switching cross-connects, configure the CCC or TCC encapsulation on the router that is acting as the switch (Router B in Figure 5).

When you use CCC encapsulation, you can configure the family ccc only. Likewise, when you use TCC encapsulation, you can configure the family tcc only.

For PPP or Cisco HDLC circuits, specify the encapsulation in the encapsulation statement. This statement configures the entire physical device. For these circuits to work, you must configure a logical interface unit 0.

```
[edit]
interfaces {
    type-fpc/pic/port {
        encapsulation (ppp-ccc | cisco-hdlc-ccc | ppp-tcc | cisco-hdlc-tcc);
        unit 0;
    }
}
```

For ATM circuits, specify the encapsulation when configuring the VC. For each VC, you configure whether it is a circuit or a regular logical interface. The default interface type is point-to-point.

```
[edit]
interfaces {
    at-fpc/pic/port {
        atm-options {
            vpi vpi-identifier maximum-vcs maximum-vcs;
        }
        unit logical-unit-number {
            point-to-point;
            eui-64 (atm-ccc-cell-relay | atm-ccc-vc-mux | atm-tcc-vc-mux | atm-tcc-snap);
            vci vpi-identifier.vci-identifier;
        }
    }
}
```

For Frame Relay circuits, specify the encapsulation when configuring the DLCI. For each DLCI, you configure whether it is a circuit or a regular logical interface. The DLCI for regular interfaces must be in the range 1 through 511. For CCC and TCC interfaces, it must be in the range 512 through 1022. The default interface type is point-to-point.

```
[edit]
interfaces {
    eui-64 frame-relay-ccc;
    type-fpc/pic/port {
        unit logical-unit-number {
            point-to-point;
            eui-64 (frame-relay-ccc | frame-relay-tcc);
            dlci dlci-identifier;
        }
    }
}
```

For Ethernet CCC circuits, specify the encapsulation in the encapsulation statement. This statement configures the entire physical device.

```
[edit]
interfaces fe-1/1/0 {
    encapsulation ethernet-ccc;
    unit 0 {
...
    }
}
```

For Ethernet VLAN circuits, specify the encapsulation in the encapsulation statement. This statement configures the entire physical device. You must also enable VLAN tagging. Ethernet interfaces in VLAN mode can have multiple logical interfaces. For encapsulation type vlan-ccc, VLAN IDs 1 through 511 are reserved for normal VLANs, and VLAN IDs 512 through 1023 are reserved for CCC VLANs. For encapsulation type extended-vlan-ccc, VLAN IDs 1 through 4094 are valid. VLAN ID 0 is reserved for tagging the priority of frames.

```
[edit]
interfaces ge-2/1/0 {
    vlan-tagging;
    encapsulation (extended-vlan-ccc | vlan-ccc);
    unit 0 {
        encapsulation vlan-ccc;
        vlan-id 600;
    }
}
```

Define the Connection for Layer 2 Switching Cross-Connects

To configure Layer 2 switching cross-connects, define the connection between the two circuits. You configure this on the router that is acting as the switch (Router B in Figure 5). The connection joins the interface that comes from the circuit's source to the interface that leads to the circuit's destination. When you specify the interface names, include the logical portion of the name, which corresponds to the logical unit number. The cross-connect is bidirectional, so packets received on the first interface are transmitted out the second interface, and those received on the second interface are transmitted out the first.

```
[edit]
protocols {
    connections {
        (remote-)interface-switch connection-name {
            interface interface-name.unit-number;
            interface interface-name.unit-number;
            transmit-lsp lsp-number;
            receive-lsp lsp-number;
        }
    }
}
```

Configure MPLS

For Layer 2 switching cross-connects to work, you must configure MPLS. The following is a minimal MPLS configuration:

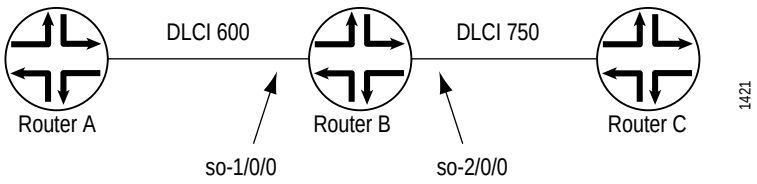
```
[edit]
protocols {
    mpls {
        interface (interface-name | all);
    }
}
```

For more information, see the *JUNOS Internet Softw are Configur ation Guide: MPLS Applications*.

Example 1: Configure Layer 2 Switching Circuit Cross-Connects

Configure a full-duplex Layer 2 switching circuit cross-connect between Router A and Router C, using a Juniper Networks router, Router B, as the virtual switch. See the topology in Figure 6.

Figure 6: Example Topology of Layer 2 Switching Circuit Cross-Connect




```
[edit]
interfaces {
    so-1/0/0 {
        eui-64 frame-relay-ccc;
        unit 1 {
            point-to-point;
            eui-64 frame-relay-ccc;
            dlci 600;
        }
    }
    so-2/0/0 {
        eui-64 frame-relay-ccc;
        unit 2 {
            point-to-point;
            encapsulation frame-relay-ccc;
            dlci 750;
        }
    }
}
```

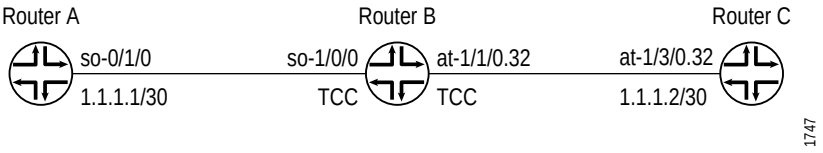
```
protocols {
    connections {
        interface-switch router-a-router-c {
            interface so-1/0/0.1;
            interface so-2/0/0.2;
        }
    }
    mpls {
        interface all;
    }
}
```

Example 2: Configure Layer 2.5 Switching Translational Cross-Connects

Configure a full-duplex Layer 2.5 switching translational cross-connect between Router A and Router C, using a Juniper Networks router, Router B, as the virtual switch. See the topology in Figure 7.

In this topology, Router B has a PPP connection to Router A and an ATM connection to Router C.

Figure 7: Layer 2.5 Switching Translational Cross-Connect



On Router A:

```
[edit]
interfaces {
    so-0/1/0 {
        description "to Router B so-1/0/0";
        encapsulation ppp;
        unit 0 {
            family inet {
                address 1.1.1.1/30;
            }
        }
    }
}
```

On Router B:

```
[edit]
interfaces {
    so-1/0/0 {
        description "to Router A so-0/1/0";
        encapsulation ppp-tcc;
        unit 0 {
        }
    }
    at-1/1/0 {
        description "to Router C at-0/3/0";
        atm-options {
            vpi 0 maximum-vcs 2000;
        }
        unit 32 {
            vci 32;
            encapsulation atm-tcc-vc-mux;
        }
    }
}
[edit]
protocols {
    mpls {
        interface so-1/0/0.0;
        interface at-1/1/0.32;
    }
    connections {
        interface-switch PPP-to-ATM {
            interface so-1/0/0.0;
            interface at-1/1/0.32;
        }
    }
```

On Router C:

```
[edit]
interfaces {
    at-0/3/0 {
        description "to Router B at-1/1/0";
        atm-options {
            vpi 0 maximum-vcs 2000;
        }
        unit 32 {
            vci 32;
            encapsulation atm-vc-mux;
            family inet {
                address 1.1.1.2/30;
            }
        }
    }
}
```